SYMPTOMS AND SIGNS IN URINARY LITHIASIS.

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As the result of the greater diagnostic accuracy obtainable by the Röntgen method in calculous nephritis and ureteritis, a more exact differentiation is possible between the symptoms and signs of these conditions. It is, however, impossible to differentiate them with precision from intra- and extra-ureteral and renal conditions without the aid of the Röntgen diagnosis.

It is not the purpose of this paper to discuss the symptomatology of these other conditions, but to point out the differences in symptoms and signs between renal and ureteral lithiasis that have a bearing upon the indications for treatment, after the size and position of the calculus has been determined by the Röntgen method. In addition, brief mention will be made of other renal conditions in which aid in diagnosis can be expected from this method in favorable cases.

This study is particularly valuable, since such additional knowledge has formed the basis for new indications for treatment which are in a great part based upon the symptom-complex presented. These symptoms and signs are best studied by discussing the atypical symptomatology, and attention can be confined chiefly to those particularly indicative symptoms that materially assist in differentiating between ureteral and renal colic, and characterize the different stages in the progress of a calculus from the renal pelvis to the bladder.

This study has for its basis my series of 352 cases examined by the Röntgen rays for suspected calculus, and particularly the 71 cases in which a calculus has been diagnosed and the diagnosis confirmed by the recovery of the calculus either at operation or when it was subsequently passed.

The differentiation between ureteral and renal colic can-

not be approximated in possibly more than half the cases by the study of symptoms and signs alone. There are, however, certain symptoms and groups of symptoms which, if only in a measure definite, suffice to form accurate indications for treatment, when taken in conjunction with the findings of the Röntgen diagnosis. That they are sufficient and of value as determining factors is evidenced by the passage of calculi in 31 cases where the expectant treatment had been based upon these indications.

The symptoms and signs cannot alone form the basis for rational treatment, as they do not comprise all the accurate knowledge that can be obtained of these conditions. On the other hand, the Röntgen diagnosis, though accurate and explicit as to the size, number and location of the calculi, does not form of itself a sufficient indication for operative removal of the stone. The symptoms and signs must in addition, and in conjunction with the Röntgen diagnosis, show that the calculus endangers the functional efficiency of the kidney or ureter, and that it is improbable that it will pass by the natural channels.

In the early days of Röntgen diagnosis much meddlesome and unwarranted surgery was done in removing sterile and harmless bodies from the tissues. In a like manner the surgical removal of some calculi would be meddlesome surgery. The Röntgen diagnosis is accurate, but should not of itself form an indication for operative removal of a calculus. The effect of the calculus upon the kidney and ureter should first be considered, and this effect, as expressed in symptoms and signs, is therefore of value in determining the indications for treatment.

In addition to the value in determining the indications for treatment, the study of the symptoms and signs is valuable in suggesting the possible presence of stone in obscure cases, and that a calculus should be detected or excluded. There are many cases in which the symptom-complex points to the presence and progress of a calculus down the ureter, but where the symptoms have suddenly ceased and even the urine may have become absolutely normal.

It is essential to the integrity of the kidney to determine whether a calculus is present and has become quiescent or occlusive, or has passed into or out of the bladder without being detected. The symptoms subside in either case and yet, if the calculus remains quiescent it may form the locus about which irritation and infection take place; if it is occlusive, a hydronephrosis results and the functional life of the kidney is threatened, as the cessation of activity means final atrophy and degeneration. If, on the other hand, it is detected in the ureter the indications for treatment will depend upon its size and the progress of the symptoms and signs, while if it is shown to have passed or to be absent from the urinary tract no treatment is required.

There is little actually known regarding the causation or method of formation of stone, and yet many factors must be properly adjusted to each other, or the normal individual would be more liable to stone formation. Mr. Reginald Harrison has pointed out that if a normal man were to void only half the 10 grains of uric acid usually excreted in a day, by the concretion of the remainder he could in forty-eight days form a stone weighing not less than half an ounce. He says: "If the production of stone were dependent upon a single link rather than upon a chain of them, it is probable that these disorders would be far more common and general than they actually are."

It may be said in addition that stones are probably much more frequently formed than one might be led to suppose by the number of cases presenting themselves for examination. This has been illustrated in a manner by the greater frequency of ureteral as compared with renal stone, since a more accurate means has been determined for finding them and a more definite knowledge of their symptoms has led to a suspicion of their presence.

All ureteral calculi probably form in the pelvis of the kidney and many undoubtedly pass without giving rise to suspicious or severe symptoms.

The symptoms and signs of calculous conditions in the kidney and ureter are due to irritation produced by their pres-

ence, to injury which they inflict in their passage or movements, or to obstruction of function. The severity of the symptoms is often in inverse ratio to their size but proportionate to the extent to which they interfere with the function of the kidney.

In nephrolithiasis, the symptoms and signs, when due to the irritation produced by the calculus acting as a sterile foreign body, are very slight unless partial or temporary occlusion is produced. A lumbar ache, increased by exertion, with a constant but small amount of albumin, has been observed in these cases. Sometimes the calculus has been very large and the albumin has persisted for eight or ten years or longer; or it may be entirely imbedded in the tissues, or enclosed in a cyst or occluded calyx. Where the calculus is rough and adhesions are present, sharp pain may have been experienced and blood is often found in the urine. The movable renal calculus of medium size produces the most characteristic and intense symptoms, with blood, if it is rough, or accompanied by pus if infection is added. The intense agony and pain of renal colic, with its quick onset without prodromes, and its almost as sudden relief, are characteristic of obstruction of the hilum. It is the classical stone in the kidney, with pain radiating often in all directions from the kidney, down the ureter to the groin, the testicle and the thigh. Temporary obstruction and mild attacks of colic have been produced by the passage of blood clots and muco-purulent plugs. When infection has been present for some time there is an absence of all acute symptoms, a dull ache in the lumbar region and pus and earthy phosphates in the urine persisting.

The most constant signs in the obscure cases are a small constant amount of albumin or traces of blood, accompanied by a constant dull ache or sense of discomfort in the renal region. Palpation is of little diagnostic value unless a large, sterile stone is present without obstruction, when tenderness may be elicited if the pelvis of the kidney can be reached. Hydro- and pyo-nephrotic kidneys can be palpated, but the information gained is only confirmatory of more obvious symptoms except where complete obstruction is present. The pres-

ence of a constant lumbar ache, with persistent albuminurea of mild degree with an absence of any history of acute attacks of colic should always suggest the possible presence of a quiescent sterile renal calculus. This suspicion would be increased if there was a trace of blood found from time to time in the urine. There have been three cases of this character among those studied. In them fixed or encysted calculi of large size have been found, one calculus measuring over 2½ inches.

It is particularly difficult during the first attack of colic to differentiate a calculus that enters the hilum of the kidney and blocks it, but does not enter the ureter, from the small calculus that has entered the ureter and can safely be allowed to pass into the bladder. The differentiation between renal and ureteral colic and the indications for treatment will be discussed after the review of the symptoms of ureteral lithiasis. As has been said, the irritation and obstruction produced by the calculus during its passage through the ureter are responsible for the symptomatology.

There is a wide range in the severity of these symptoms, depending upon the degree of irritation and the completeness and point at which the obstruction takes place, the size and character of the calculus bearing an evident relation. The symptoms are so clearly subdivided by the point at which the obstruction takes place that they will be studied according to this subdivision. The most common seat of impaction has been the uretero-iliac junction, and the second that point in the juxta-vesical portion of the ureter where it enters the wall of the bladder. The portion above and the portion below the uretero-iliac junction exhibit symptoms that are distinct and characteristic of their involvement, though in some cases there has been a merging of the one into the other. In general it may be said that the symptoms of calculus approximate those of renal lithiasis when the upper portion of the ureter is involved, while vesical calculus is so closely similated by calculous involvement of the lower portion that in more than one of these cases the bladder had been opened and explored for stone.

In the upper portion of the ureter the seats of impaction

of calculi are at the uretero-iliac junction, where the ureter bends and is flattened in crossing the artery, and at a point of narrowing about an inch below the lower pole of the kidney. This latter point is where the larger calculi that pass from the kidney may become lodged and are then liable to give rise to acute symptoms of obstruction. These are the calculi that more frequently demand operative removal. The smaller calculi, since they produce less marked symptoms, are more difficult to detect and are often more dangerous on this account. They may cause complete obstruction with very few or no marked symptoms, or may even, when no larger than a grape seed, cause intense and acute paroxysms of pain, with hæmorrhage out of all proportion to their size. It is in the insidious attacks with few or masked symptoms that an exact knowledge of the position, size and location of the calculus is most essential to the safety of the patient. These cases have little danger so soon as the exact size and location of the calculus has been determined, and the presence of a bilateral urinary flow, with a normal excretion of urea established. The frank, open cases, with severe attacks of pain, lose their grave aspect when it is known that the calculus is small enough to pass and what its exact position is in the ureter. A previous history of a series of attacks increasing in frequency, after the exact diagnosis has been established, means in such cases that natural forces are working and are competent to finally expel the calculus. Each attack can then be welcomed as an evidence of continued activity and each as a step nearer permanent relief.

Occlusion generally precedes the onward movement of a calculus in the ureter. By obstructing the urinary flow it produces distention of the ureter and pelvis of the kidney. These, in contracting, produce the force which dilates the ureter at the seat of the calculus impaction, and pushes it onward. This process is slow and gradual and gives rise to symptoms that extend over long periods. There may be a constant lumbar ache that persists between attacks, with an increasing ache and discomfort, prodromal in character, during the distention of the ureter. The acute attack of ureteral colic following it,

and subsiding after the calculus has been pushed along or the urine has escaped around it. This flush-tank variety of hydronephrosis is characteristic of these attacks, but may also be caused by an interferenee with the urinary flow, as by twists or valves in the ureter.

The history of a caleulus passing down the ureter is characteristic. Attacks increasing in frequency and generally in severity should lead to the suspicion of a quiescent calculus that occasionally produees obstruetion and may or may not be passed, depending on its size, and its location in successive attacks. The attacks may not be identical in symptomatology, but a sufficient number of the symptoms are repeated to establish their identity, while the lumbar ache and discomfort preeedes and follows each attack, becoming continuous as they come closer together.

Beside this prodomal lumbar ache that persists and subsides gradually after the sharp colic attack, ureteral lithiasis is characterized by the radiation of the pain. In the crisis of the aeute eolic there is generally a point in the line of the ureter from which the pain seems to shoot upward into the kidney and downward along the distribution of the genito-erural nerve. The point of greatest intensity is frequently over the seat of obstruetion, and when the upper portion of the ureter near the kidney is involved the pain is aecompanied by nausea and vomiting. This is more liable to oceur when there is eomplete oeclusion. The distribution of the pain differs from that of renal caleulus in that it does not radiate around the body, and from that of calculus in the juxta-vesieal portion of the ureter in that it does not approximate that of vesical stone. That is to say, the pain is felt in the scrotum, testicle or labium major, and down the thigh, and in the groin. It does not involve the glans penis, the urethra or the meatus urinarius. In addition to the pain, stone in the upper ureter often produces a reflex contraction of the psoas muscle, due apparently to irritation. There is found to be a eharaeteristic tendency to flex the thigh upon the body in these cases and an unwillingness to extend it, even after the acute attack of pain has subsided.

Palpation in these cases often yields valuable results. While the ureter can be palpated and its thickened and tender condition noted, in other forms of chronic ureteritis, in calculus ureteritis it is often possible, not only to detect and palpate the distended ureter, but also to locate an exquisitely tender point, and even to feel the calculus. To palpate a calculus impacted at the uretero-iliac junction, the patient should lie with limbs extended. The bifurcation of the aorta into the common iliacs should then be found and the finger carried along the common iliac artery 1½ to 2 inches. The pulsation of the iliac can often be felt, and if a calculus is present an intensely tender spot sharply localized will be encountered. This tenderness has been confused with that of an inflamed appendix, or a displaced and inflamed ovary, and these organs have been removed in some cases in which a calculus was subsequently found and removed from the ureter. The ureter may or may not be found distended above the calculus as a hydro-ureter, when distended as the result of occlusion the similarity to an inflamed appendix is more marked. Palpation is also of value when calculi lie low down in the juxta-vesical portion of the ureter, where they can be felt through the rectum or vagina.

The most characteristic sign of ureteral stone, especially the freely movable or small rough calculi, is repeated traces of fresh blood in the urine. This sign may, however, be entirely wanting if the calculus has been quiescent. Where obstruction has been present, sufficient to produce backward pressure upon the kidney, albumin may be found. When complete occlusion has taken place the urine may be perfectly normal, since it may come from but one kidney, but the daily amount of urea excreted may be too low. Infection and pus in ureteral lithiasis have accompanied calculi lodged just below the kidney or just outside the bladder, and has been sufficiently intense, with such grave acute symptoms as to demand immediate operation. In these instances the accurate localization facilitated and was confirmed by the operation.

The symptoms of calculus in the juxta-vesical portion of the ureter differ distinctly from those of calculus at or above

the uretero-iliac junction. The signs are nearly identical, though there is less liability to blood in the urine, and more chance of infection. There is often a history of previous attacks one, two, three or more years, or as many months, apart, with an increasing frequency during the last year or six months. The point of acute pain will be found, in a calculus that is passing down the ureter, to be gradually lower and will usually mark the points where impaction is most frequent. There is often a sense of fulness in the renal region, the result of an hydronephrosis of either passive or flush-tank variety. This is more common with calculus impacted at the uretero-iliac junction, while infection is more liable to occur when the impaction is near the bladder and the occlusion is incomplete.

The most noteworthy characteristic of the pain symptomatic of calculus in the juxta-vesical portion of the ureter is the closeness with which it resembles that of vesical or prostatic calculus. The presence of some of the symptoms of ureteral lithiasis and pain ascending to the kidney or down to the thigh should lead to a suspicion of the true cause. The symptoms simulating vesical stone are apparently due to the involvement of the same nerve supply and interference with the vesical trigone. The pain is referred to the glans penis or the meatus in the female and along the line of the urethra. It may be very intense, and is often felt while the bladder is contracting as well as at the end of micturition. Pain in the scrotum and testicle or the labium major, in the groin and the inner side of the thigh, are also often present with pain ascending to the kidney, and, less frequently, a dull lumbar ache.

Acute attacks of colic are more rare, especially if the calculus has been quiescent. Partial occlusion may result in hydro-ureter and hydronephrosis, or these may be combined with infection. Infection may produce very severe symptoms resulting in complete occlusion and often demands immediate operation. In one patient three calculi smaller than grape-seeds, together with infection, produced occlusion which was relieved and the calculi removed by operation at the seat of impaction. In other cases the bladder has been opened and

explored for encysted calculi or has been treated for cystitis when the ureter was the seat of the disease. As in calculus situated above the iliac artery, there is great difficulty in differentiating calculus conditions of this portion of the ureter from extra-ureteral or intra-ureteral conditions. In fact, it is because the similarity in symptomatology is so close and an exact method of diagnosis did not exist, that the Röntgen method is so valuable and has made possible a closer differentiation in the symptomatology.

An exact diagnosis cannot be made without the assistance of the Röntgen method, even with the more definite understanding of the symptoms. Their study is most valuable as confirmatory evidence and in securing data upon which the

The differences in the symptoms of renal and ureteral colic are that the onset and end of the attack are more sudden. Ureteral colic is preceded by a prodromal lumbar ache that becomes more intense until the crisis or acute attack of pain. This lumbar ache subsides by lysis and may not entirely disappear between the colic attacks. The pain is localized at the seat of obstruction in the ureter and radiates upward as well as downward. In the kidney the pain is most acute in the region of that organ and radiates downward or around the body, while if there has been an ache from a quiescent renal calculus, it has not gradually increased in volume, and is generally absent after the attack. In colic due to calculus in the upper ureter there is generally reflex irritation of psoas muscle and contracture, while palpation will detect a distended and tender ureter with an acute point of tenderness at the seat of impaction. The hydronephrotic kidney can be felt sometimes in both conditions, but is fluctuating and of the flush-tank variety in ureteral stone.

In calculus impacted in the juxta-vesical portion of the ureter the symptoms of ureteral calculus are combined with those of vesical stone, with the absence of the psoas reflex and the point of tenderness at the uretero-iliac junction. There is less liability to lumbar-ache and fewer attacks of colic, especially if the calculus has become quiescent.

The previous history of the attacks, with their intervals, is very valuable when the information is given by intelligent persons. With a series of attacks extending over a period of months or years, with a shortening interval between the attacks and pain localized during the acute colic lower and lower down, with at first no lumbar ache and finally a persistent lumbar ache, or ureteral and vesical symptoms intermingled, the picture is complete of the progress of a calculus down the ureter, and it becomes almost certain if to this history and symptoms that are confirmatory is added the presence of occasional traces of blood. But even with so typical a history and the subsidence of symptoms it is impossible to say that a calculus was ever present, or if present that it has not passed undetected.

Such a history, or even a partial history with many symptoms lacking, in the presence of a small stone detected by the Röntgen method, is sufficient evidence upon which to base a rational course of treatment. If the urinalysis shows that a normal amount of urea is being excreted; if the attacks have been intense and if a lumbar-ache persists, there is evidence that nature is attempting to expel the calculus, that the patient is in no immediate danger due to suspension of functional activity, and that the kidney and ureter still possess sufficient contractile power to expel the stone.

If, on the other hand, the calculus is large, and frequently repeated attacks of colic fail to produce any change in its location, or if infection is present, or acute symptoms develop, or the amount of urea becomes persistently low, the indications for the immediate removal of the calculus are present.

The detection of a large calculus in the kidney is an indication for operation unless the calculus is producing but few symptoms and the age of the patient or any physical disability makes the operative risk grave.

A small calculus in the kidney without complications, where there has been but one or two colic attacks, may be permitted to remain, as they are frequently passed, one patient passing a small calculus from the kidney and out of the bladder on the day set for operation.

The toleranee of the kidney and ureter for small sterile caleuli is so fully demonstrated by many cases that have passed numerous calculi in series, that the detection of a ealeulus is not an indication in itself for opcration. Multiple ealculi either in both ureters or in the kidney and ureter are indieations for primary operative removal of the ealeulus in the ureter. Multiple ealeuli deteetcd in one ureter have all been passed in two or more eases. The mortality in ureter-lithotomy is high, especially for calculi situated below the iliae artery, and in the presence of 31 eases of ureteral caleulus that have passed the caleuli after the patients were put upon the expeetant treatment, operation seems to be justified only in thc advent of aeute symptoms, or whcre both urinary tracts are involved.

As I havc said in a former paper (*The Lancet,* London, June 17, 1905) " While the prcsencc of an undeteeted calculus may be a grave danger and a menaee to the integrity of the kidney, as soon as its cxact size and location are known that menaee eease, unless there are symptoms present that indicate a progressive impairmcnt of the function of the kidney. Comparatively few migrating calculi give rise to anuria, or a grcater proportion of paticnts suffering from urcteral stone would die."

With the knowledge that so many patients pass ealeuli, and an aceurate mcthod of determining their size and loeation, it is rational thcrapy to permit naturc to accomplish that which she has accomplishcd in a large number of cases.

Because of the exact knowledge obtainable the patient's safety can bc guarded during such cxpectant treatmcnt and operation ean be direeted to the seat of obstruetion if it is needed. It is, however, irrational to operate beeause a calculus has been detected unless it threatens the integrity and funetional life of the kidney.

Although the same accuracy and detail have not been obtained in other pathologie eonditions of the kidney, much that is valuable and assists materially in diagnosis can be secured in favorable cases. Thus displacements, hydro- and pyo-nephroses and hypertrophies of the kidney have been

demonstrated. Pus or debris filling the pelvis of the kidney have been detected and the pus has been washed out through the use of the ureteral catheter. Cysts external to the kidney and gross collections of pus in the cortex, as well as the more marked surgical kidney, have been recognized. These refinements in diagnosis can be obtained only in favorable cases and by careful study of the negatives. It is not always possible to determine or distinguish one condition from another, and yet there is absolute evidence to the expert observer of a pathological condition.

In closing, it is perhaps worthy of note that in none of the 352 cases examined for a diseased condition of the kidney, has any deleterious effect been observed as the result of the examination, with the exception of some cases of dermatitis among the earlier cases. No dermatitis has occurred during the past four years. The innocuousness of Röntgen examinations is apparently demonstrated by these cases with renal disease and the thousands of other cases examined without harmful results.